Claims

1. An improved phosphor film for a thick film dielectric electroluminescent display, said phosphor film selected from the group consisting of:

(a) a rare earth activated barium thioaluminate;

(b) a rare earth activated fine grained zinc sulfide;

(c) a transition metal activated zinc sulfide;

(d) a rare earth or transition metal activated zinc selenide; and

(e) a rare earth or transition metal activated zinc sulfo-selenide,

- wherein said phosphor film of (a), (b) (d) and (e) is provided with an aluminum nitride barrier layer on a top and/or bottom side of the phosphor film and wherein said phosphor film of (c) is provided with an aluminum nitride barrier layer on the top side of said phosphor film, said aluminum nitride barrier layer improving the stability of the interface between the phosphor film and the display.

2. The phosphor film of claim 1, wherein said barium thioaluminate phosphor has the formula AB_xC_y:RE wherein;

A is selected from one or more of the group consisting of Mg, Ca, Sr and Ba;

B is selected from one or more of the group consisting of Al, Ga and In;

C is selected from one or more of the group consisting of S and Se; and RE is a rare earth activator species.

3. The phosphor film of claim 2, wherein C may also include oxygen at a relative atomic concentration that is less than 0.2 of the combined S and Se concentrations.

4. The phosphor film of claim 2, wherein RE is selected from the group consisting of Eu and Ce.

5. The phosphor film of claim 1, wherein said aluminum nitride barrier layer is provided on top of said phosphor of (a) to (e).

6. The phosphor film of claim 1, wherein said aluminum nitride barrier layer is provided on the bottom of said phosphor of (a), (b), (d) and (e).

7. The phosphor of claim 1, wherein said aluminum nitride barrier layer is provided on the top and bottom of said phosphor of (a) to (e).

8. The phosphor of claim 1, wherein said aluminum nitride barrier layer is about 30nm to about 50nm thick.

9. The phosphor of claim 8, wherein said aluminum nitride barrier layer is deposited by sputtering.

10. The phosphor of claim 9, wherein said sputtering in a sputtering atmosphere of gases at a pressure of about 0.65Pa to 3.5Pa in a nitrogen to argon ratio of about 0:50 to 20:50 and a power density of about 2 to 6 watts per square centimeter.

11. The phosphor of claim 10, wherein oxygen is added to said sputtering atmosphere.

12. The phosphor of claim 8, wherein said aluminum nitride barrier layer is deposited by atomic layer chemical vapour deposition.

13. The phosphor of claim 8, wherein said aluminum nitride barrier layer has a optical index of refraction of up to about 2.0.

14. The phosphor of claim 1, wherein said fine grained rare earth activated zinc sulfide phosphor layer has the formula ZnS:RE, wherein RE is selected from the group consisting of terbium and europium and wherein said phosphor has a crystal grain dimension of up to about 50nm.

15. The phosphor of claim 14, wherein the atomic ratio for terbium or europium to zinc is about 0.005 to 0.02.

16. The phosphor of claim 15, wherein said zinc sulfide phosphor has a sphalerite crystal structure.

17. The phosphor of claim 1, wherein said zinc sulfo-selenide is represented by the formula ZnS_xSe_{1-x}:A where $0<x<1$ and A is an activating element.

18. The phosphor of claim 1, wherein said zinc selenide phosphor material is represented by ZnSe:A where A is an activating element.

19. The phosphor of claim 1, wherein said transition metal activated zinc sulfide is represented by the formula ZnS:A where A is selected from manganese and terbium.

20. A phosphor laminate for use in a thick film dielectric electroluminescent display, said phosphor laminate comprising;

- a phosphor thin film layer selected from the group consisting of
  - (a) a rare earth activated barium thioaluminate;
  - (b) a rare earth activated fine grained zinc sulfide;
  - (c) a transition metal activated zinc sulfide;
  - (d) a rare earth or transition metal activated zinc selenide; and

(e) a rare earth or transition metal activated zinc sulfo-selenide, and

- an aluminum nitride layer provided directly adjacent a top and/or bottom side of the phosphor layer of (a), (b) (d) and (e) and wherein said aluminum nitride layer is provided directly adjacent a top side of said phosphor layer of (c).

21. The laminate of claim 20, wherein said aluminum nitride barrier layer has a thickness of about 30nm to about 50nm.

22. The laminate of claim 21, wherein said phosphor thin film layer is (a) and said aluminum nitride barrier layer is provided on the top side of said phosphor thin film layer.

23. A thick film dielectric electroluminescent device constructed on a glass or glass ceramic substrate and comprising a phosphor selected from the group consisting of;

(a) a rare earth activated barium thioaluminate;

(b) a rare earth activated fine grained zinc sulfide;

(c) a transition metal activated zinc sulfide;

(d) a rare earth or transition metal activated zinc selenide; and

(e) a rare earth or transition metal activated zinc sulfo-selenide,

- wherein said phosphor film of (a), (b) (d) and (e) is provided with an aluminum nitride barrier layer on a top and/or bottom side of the phosphor film and wherein said phosphor film of (c) is provided with an aluminum nitride barrier layer on the top side of said phosphor film, said aluminum nitride barrier layer improving the stability of the interface between the phosphor film and the device.

24. The device of claim 23, wherein said aluminum nitride barrier layer has a thickness of about 30nm to about 50nm.

25. A method for making a stabilized phosphor laminate for use in a thick film dielectric electroluminescent device, said method comprising;

i) deposition of a phosphor selected from the group consisting of:

(a) a rare earth activated barium thioaluminate;

(b) a rare earth activated fine grained zinc sulfide;

(c) a transition metal activated zinc sulfide;

(d) a rare earth or transition metal activated zinc selenide; and

(e) a rare earth or transition metal activated zinc sulfo-selenide,

onto a glass or glass ceramic substrate incorporating a first set of address lines and a dielectric layer;

iii) deposition of a layer of aluminum nitride on top of said phosphor film of (a)-(e); and

ii) annealing said phosphor film at a temperature of up to about 1100°C.

26. The method of claim 25, wherein said method further comprises deposition of a layer of aluminum nitride on the bottom of said phosphor film of (a), (b), (d) and (e).

27. The method of claim 26, wherein said aluminum nitride has a thickness of about 30nm to about 50nm.

28. The method of claim 27, wherein said aluminum nitride barrier layer is deposited by sputtering.

29. The method of claim 28, wherein said sputtering in a sputtering atmosphere of gases at a pressure of about 0.65Pa to 3.5Pa in a nitrogen to argon ratio of about 0:50 to 20:50 and a power density of about 2 to 6 watts per square centimeter.

30. The method of claim 29, wherein oxygen is added to said sputtering atmosphere.

31. The method of claim 27, wherein said aluminum nitride barrier layer is deposited by atomic layer chemical vapour deposition.